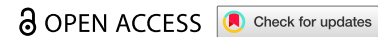


RESEARCH ARTICLE



Ribbing without tooling: additive manufacturing of thermoplastic ribs on thermoset skins enabled by co-cured thermoplastic interphases

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ABSTRACT

This work evaluates tooling-reduced ribbing by printing thermoplastic stiffeners onto thermoset composite skins via co-cured, directly printable thermoplastic interphases. A helicopter door demonstrator provides the application context for localized reinforcement features in regions where SMC processing is constrained by limited flow and tooling-driven draft angles. Two material routes were investigated on M18/1 CFRP coupons as repeatable screening platforms. PEI served as a high-temperature reference interphase for printing PEI and PPSU, while PC was evaluated as a lower-temperature interphase for printing PETG. Differential scanning calorimetry was used to define substrate-temperature levels, and single-lap-shear tests provided first-order indicators of interface quality and process sensitivity. The results reveal a coupled thermal process window: insufficient activation leads to weak bonding, whereas excessive thermal exposure reduces lapshear strength despite successful deposition. An analytical model further quantifies the lightweighting potential of eliminating demolding draft angles, showing double-digit crosssectional mass savings for typical rib proportions.

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